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MEMORANDUM FOR: Nancy Thompson

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FROM: Michael Prager

SUBJECT: SEDAR Vermilion Snapper and Black Seabass Corrections

As you are aware, a data transcription error was identified after the review of the recent SEDAR assessment of vermilion snapper in the Atlantic. The error occurred when recreational (MRFSS) landings data were scaled from kilograms to metric tons, although they were already in metric tons. Therefore, the assessment model was run on data that under-represented the MRFSS landings. The results in the Assessment Workshop report reflect that error, as it was discovered after completion of the SEDAR peer review.

When we became aware of the error, the Population Dynamics team in Beaufort recomputed the base run and sensitivity runs on the corrected data set. This memorandum is to advise you of the results of the corrected model runs.

We also reviewed the input data files used for both assessment models against the data files supplied by data holders during or following the Data Workshop. A few other issues were identified. Among them were use of standard error rather than coefficient of variation for weighting the MARMAP hook-and-line index (vermilion snapper); use of the 1984–1989 maturity vector rather than the 1978–1983 vector for 1983 (black seabass); a weakly determined selectivity specification for the early years (black seabass); and a penalty on large deviations in F over the last 5 vs. last 3 years (black seabass). In all these cases, model sensitivities were examined, and the resulting estimates of stock status and benchmarks demonstrated little, if any, difference. The sensitivity runs are included on the SEDAR CD along with the wide range of other sensitivities considered by SEDAR participants.

A major goal of the SEDAR process is quality assurance of stock assessments. In light of the issues noted above, we have devised new procedures to strengthen quality assurance in future SEDAR assessments. Those procedures are described for your approval in a separate memorandum.

Vermilion Snapper Landings Data Correction

Corrected MRFSS landings of vermilion snapper represent about 21% of the Atlantic landings of vermilion snapper off the southeast U.S. (Table 1, Figures 1 and 2).

Table 1. Landings (mt) of vermilion snapper in the southeast U.S. Atlantic Ocean.

Year	Commercial hook-and-line	Commercial trawl	Commercial other	Headboat	Recreational MRFSS
1970	7.8	1.0	0.0	--	--
1971	20.5	2.7	0.0	--	--
1972	28.7	3.5	5.6	--	--
1973	36.2	5.0	1.8	--	--
1974	49.8	5.3	0.4	--	--
1975	83.5	9.4	0.4	--	--
1976	84.3	11.0	3.4	146.8	--
1977	101.0	12.3	4.8	90.8	--
1978	144.8	6.6	1.4	131.2	--
1979	160.4	25.0	17.5	97.2	--
1980	187.3	78.1	64.4	90.0	--
1981	185.6	60.6	57.1	104.5	19.6
1982	252.1	62.8	59.4	154.2	322.1
1983	221.4	52.6	49.3	134.0	316.8
1984	298.9	47.5	41.9	111.3	251.2
1985	415.8	14.4	6.5	202.7	672.2
1986	406.8	11.0	7.3	158.5	50.3
1987	330.4	9.6	9.1	205.0	128.0
1988	369.8	46.7	41.3	189.9	130.8
1989	509.5	10.4	6.3	157.2	248.9
1990	539.6	15.5	43.8	175.4	105.6
1991	614.0	12.6	22.4	151.2	181.4
1992	341.8	5.8	0.3	113.2	95.8
1993	401.4	1.7	2.8	117.3	104.0
1994	431.7	11.6	3.1	127.8	73.9
1995	415.1	15.4	3.9	123.7	88.5
1996	340.0	5.0	2.3	125.6	81.5
1997	346.0	2.2	2.3	138.5	94.7
1998	323.9	1.1	0.6	125.3	99.7
1999	354.1	5.0	6.6	159.2	208.7
2000	510.1	16.0	2.9	190.3	261.7
2001	615.6	31.0	0.5	192.5	243.7

Figure 1. Atlantic landings (mt) of vermilion snapper off the southeast U.S.

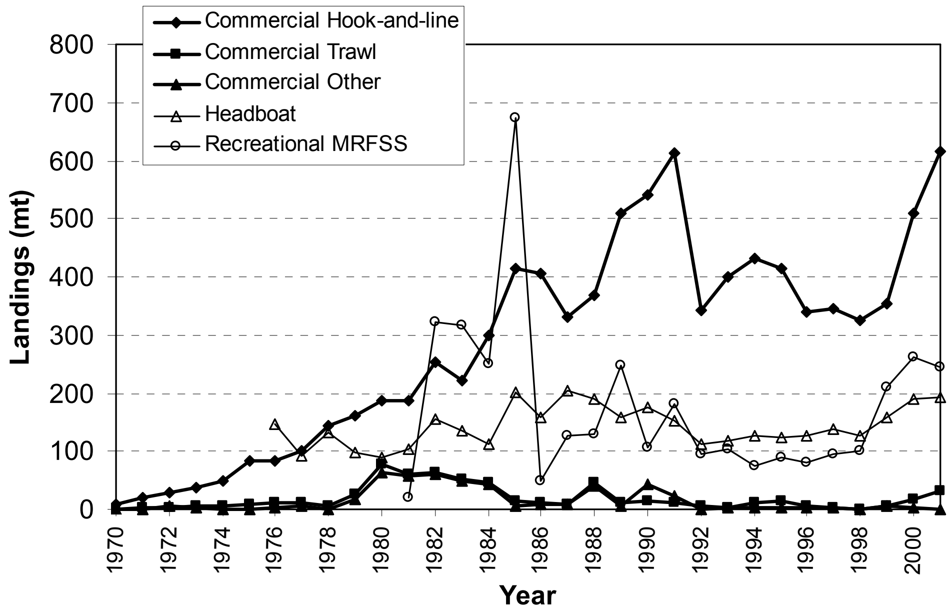
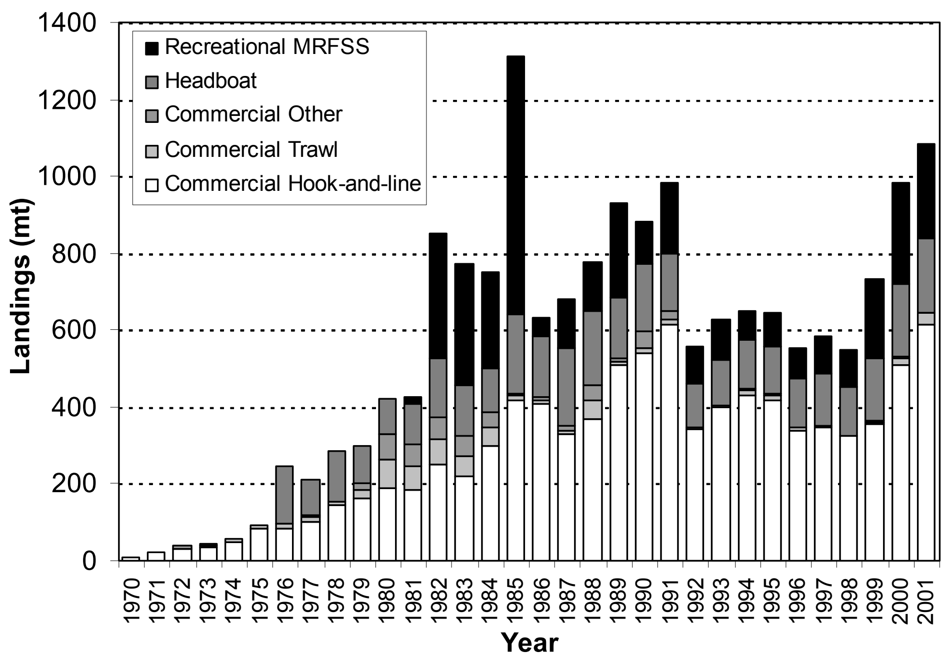


Figure 2. Total landings (mt) of vermilion snapper in the southeast U.S. Atlantic Ocean



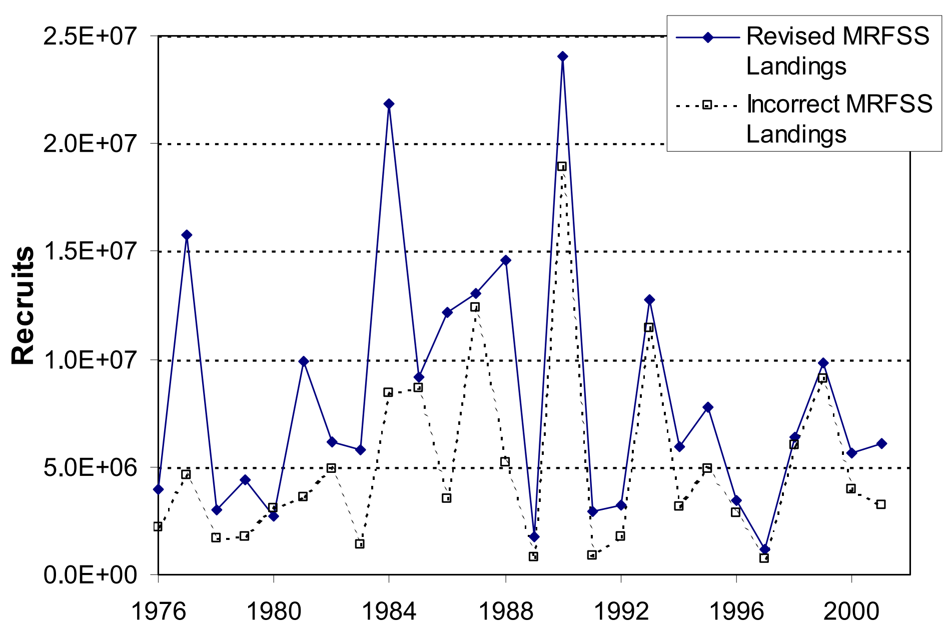
Revised assessment results

Revised runs of the vermilion snapper model were made with corrected MRFSS landings but no other changes. Results of the corrected base run (M=0.25/yr and steepness estimated) are compared to the original base run in the following figures. Comparison of corresponding sensitivity runs can be made by examining Table 2 and Figure 7.

Recruitment

Annual estimates of recruitment were higher in the corrected run, as would be expected from the increase in landings data, but the general pattern in recruitment was similar to the original run (Figure 3). Estimated recruitment in 1984 differed the most between runs, which is probably a result of the unusually large landings estimate by MRFSS in 1985 (Figure 1). Estimates from MRFSS in the mid-1980s have appeared irregular in a number of species.

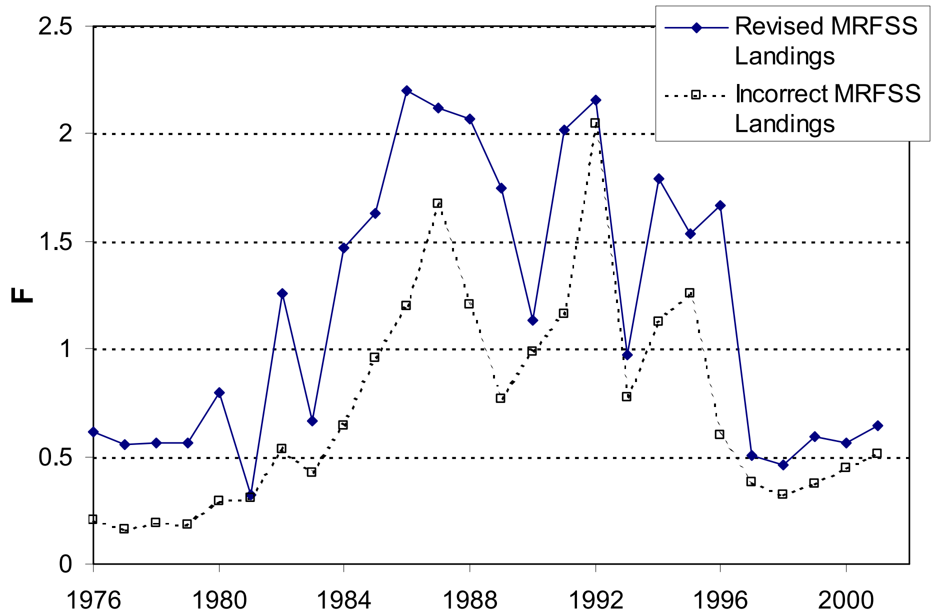
Figure 3. Recruitment estimates from the base run vermilion snapper model.



Fishing Mortality Rate

Estimates of fully-selected fishing mortality rate F were higher in the corrected run, and again the general pattern estimated was similar to that of the original analysis (Figure 4). Estimates of F for the most recent years differed least between runs (Figure 4).

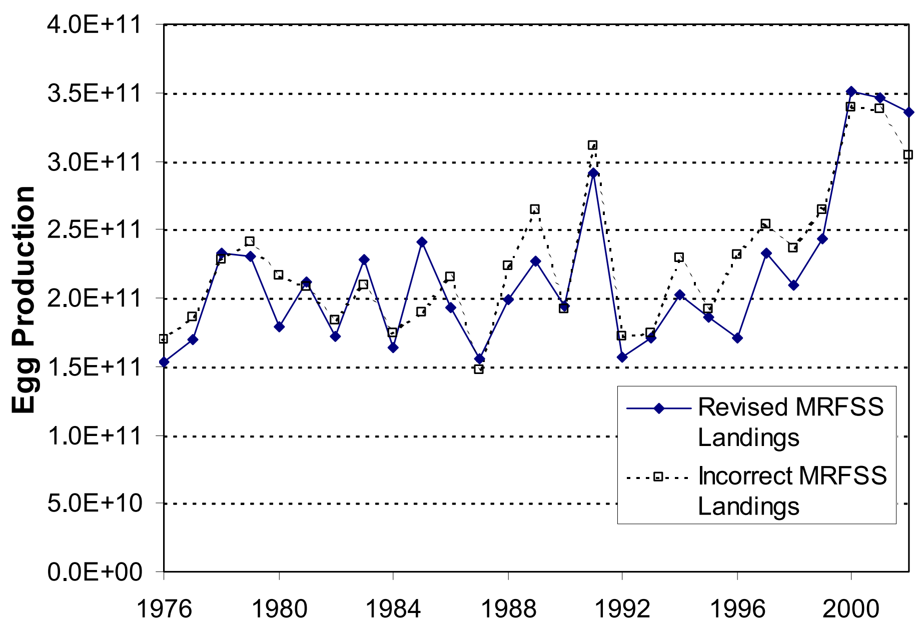
Figure 4. Fishing mortality rate (F) estimates from the base run vermilion snapper model.



Spawning-stock size (egg production)

Estimates of egg production did not change appreciably with the corrected landings (Figure 5).

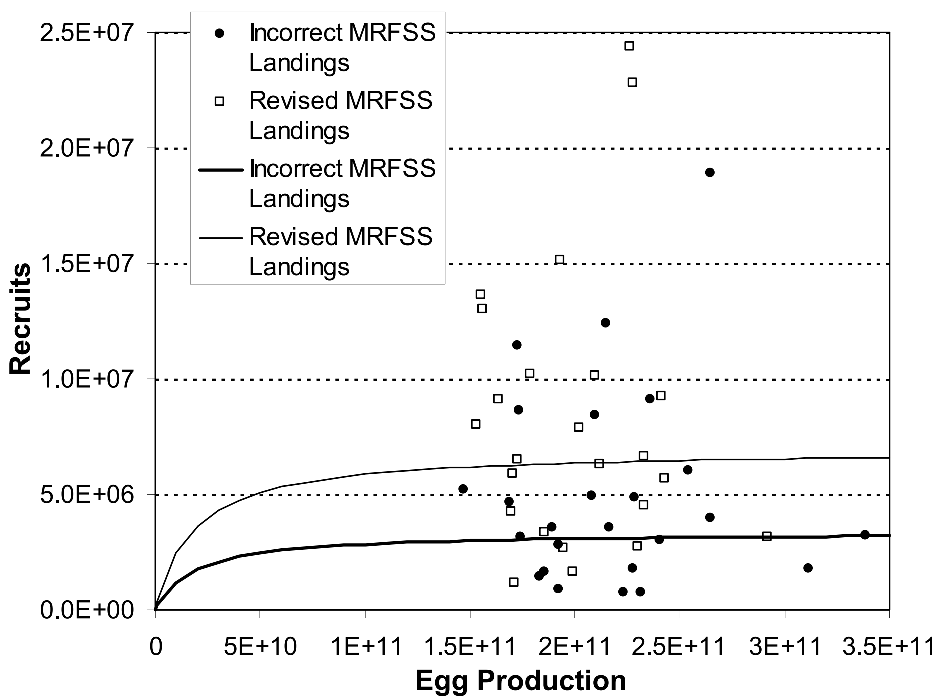
Figure 5. Egg production estimates from the base run vermilion snapper model.



Stock–recruitment curve

The combination of higher recruitment estimates and relatively unchanged egg-production estimates resulted in an increase in the estimated stock–recruit curve (Figure 6). The overall pattern of estimated stock–recruit data was similar. As noted in the Assessment Workshop report, these stock and recruitment data are relatively uninformative about the underlying stock–recruit relationship, a situation that causes substantial uncertainty in estimating maximum sustainable yield (MSY) and its associated benchmarks, F_{MSY} and E_{MSY} (for vermilion snapper, egg production E is used to represent spawning-stock size).

Figure 6. Stock-recruit curve estimates from the base runs of vermilion snapper model.



Benchmarks and status indicators from base runs

The customary SFA benchmarks and status indicators are based on MSY theory, which means that in an age-structured context they depend on the stock–recruitment relationship. As noted above, the stock and recruitment estimates for this stock did not define that relationship very well, either in the original base run or in the corrected base run. Adding to this uncertainty, the estimated steepness parameter (h) of the recruitment curve reached the upper bound of allowed values in the corrected base run, an indication that the data are uninformative about expected recruitment at lower levels of spawning stock size. That result further weakens the credibility of

MSY-based estimates from that run and strengthens the argument for using proxy-based benchmarks and status indicators instead.

Nonetheless, estimates of benchmarks and status indicators in F were similar between the original and corrected base runs (bold rows in Table 2). In particular, Fmsy differed only slightly (an increase from 0.32/yr to 0.36/yr), and the ratio of F in 2001 to Fmsy also increased (from 1.6 to 1.8). Because of the uncertainty in the stock–recruitment curve, the review panel recommended using Fmax as a proxy for Fmsy. Fmax increased slightly (from 0.35 to 0.38) and the ratio of F in 2001 to Fmax also increased (from 1.48 to 1.71; not shown in Table 2) when the data were corrected. Thus, the original run and the run on corrected data both indicate the stock as currently undergoing overfishing, regardless of whether Fmsy or a proxy based on Fmax is used.

The situation is less clear when benchmarks and status indicators in spawning-stock biomass are considered. Although using Fmax as a proxy for Fmsy avoids the uncertainty associated with the stock–recruitment relationship, the expected spawning-stock biomass (or egg production) associated with Fmax still depends on an estimate of average future recruitment. As that is not well estimated from the available data, all estimates of biomass-related benchmarks and status are highly uncertain. Subject to that uncertainty, the original base run estimated that egg production in 2002 was 1.23 of the egg production associated with MSY, while the corresponding estimate from the corrected run was 0.66, which would correspond to the overfished condition. Both the Assessment Workshop report and the review panel (in its Advisory Report on Stock Status) were reluctant to accept estimates of biomass status at face value.

Sensitivity runs and phase plots

Estimates of status indicators from all sensitivity runs (Figure 7) are credible only to the degree that the data in Figure 6 define a meaningful stock–recruitment relationship. In both panels, sensitivity runs C, F, and J resulted from assuming a rather low value of steepness (h=0.5), which was specified as a sensitivity value but not necessarily thought realistic by Data Workshop and Assessment Workshop participants. Taken at their face value, most estimates in Figure 7(b) imply that the stock is in an overfished condition. The sensitivity runs, however, should be considered with no less skepticism than the base runs where MSY-based benchmarks are concerned. As in the base runs, estimates of Fmax are not influenced by uncertainty of the recruitment curve. Estimates of Fmax (the proxy for Fmsy recommended by the review panel) from the corrected runs are similar to those from the original runs (Table 2).

Table 2. Parameter estimates of natural mortality (M), steepness (h), virgin recruitment (R0), fishing mortality (F), maximum fishing mortality threshold (MFMT), egg production (E), and maximum spawning stock threshold (MSST) from the base and sensitivity runs for the vermilion snapper model.

Estimates from Assessment Workshop report

Run	M	h	R0	F(2001)	Fmsy	F(2001)/ Fmsy	F40%	Fmax	MFMT	F(future)	Emsy	E(2002)	E(2002)/ Emsy	MSST
A	0.2	0.93	3.97E+06	0.56	0.295	1.89	0.265	0.315	0.25	0.45	3.96E+11	2.74E+11	0.69	3.17E+11
B	0.2	0.7	4.62E+06	0.56	0.235	2.37	0.28	0.33	0.18	0.50	4.66E+11	2.89E+11	0.62	3.73E+11
C	0.2	0.5	2.47E+09	0.55	0.16	3.45	0.285	0.35	0.00	0.49	2.57E+14	3.15E+11	0.00	2.06E+14
D	**0.25**	**0.9**	**3.27E+06**	**0.51**	**0.32**	**1.60**	**0.32**	**0.345**	**0.32**	**0.44**	**2.47E+11**	**3.04E+11**	**1.23**	**1.85E+11**
E	0.25	0.7	6.37E+06	0.56	0.265	2.10	0.335	0.36	0.22	0.50	5.04E+11	3.08E+11	0.61	3.78E+11
F	0.25	0.5	6.82E+08	0.55	0.18	3.06	0.33	0.355	0.00	0.49	5.65E+13	3.34E+11	0.01	4.24E+13
G	0.3	0.95	4.09E+06	0.53	0.34	1.55	0.345	0.35	0.34	0.46	2.76E+11	3.11E+11	1.13	1.93E+11
H	0.3	0.7	5.16E+06	0.54	0.28	1.93	0.37	0.37	0.28	0.48	3.38E+11	3.11E+11	0.92	2.37E+11
J	0.3	0.5	2.24E+08	0.54	0.195	2.78	0.37	0.37	0.01	0.48	1.52E+13	3.59E+11	0.02	1.06E+13

Estimates with corrected MRFSS landings

Run	M	h	R0	F(2001)	Fmsy	F(2001)/ Fmsy	F40%	Fmax	MFMT	Ffuture	Emsy	E(2002)	E(2002)/Emsy	MSST
A	0.2	0.95	6.66E+06	0.67	0.325	2.05	0.27	0.34	0.21	0.62	6.28E+11	3.23E+11	0.51	5.02E+11
B	0.2	0.7	3.34E+08	0.65	0.24	2.69	0.275	0.34	0.00	0.60	3.28E+13	4.15E+11	0.01	2.62E+13
C	0.2	0.5	3.04E+08	0.01	0.165	0.05	0.37	0.3	0.17	0.01	2.25E+13	2.52E+13	1.12	1.8E+13
D	**0.25**	**0.95**	**6.84E+06**	**0.64**	**0.36**	**1.78**	**0.33**	**0.375**	**0.32**	**0.60**	**5.06E+11**	**3.35E+11**	**0.66**	**3.8E+11**
E	0.25	0.7	1.83E+07	0.64	0.275	2.33	0.33	0.375	0.10	0.60	1.41E+12	3.72E+11	0.26	1.06E+12
F	0.25	0.5	2.48E+08	0.01	0.175	0.04	0.48	0.295	0.18	0.01	1.70E+13	2.66E+13	1.57	1.27E+13
G	0.3	0.95	9.59E+06	0.68	0.385	1.77	0.365	0.4	0.31	0.63	6.15E+11	3.46E+11	0.56	4.3E+11
H	0.3	0.7	1.83E+07	0.65	0.3	2.15	0.375	0.4	0.14	0.60	1.17E+12	3.79E+11	0.32	8.17E+11
J	0.3	0.5	1.67E+07	0.20	0.2	0.98	0.505	0.345	0.20	0.15	1.01E+12	1.39E+12	1.38	7.05E+11

Figure 7. Relative benchmark estimates for vermilion snapper from original runs (a) and runs with corrected MRFSS landings data (b). Base run in each case is labeled D and shown with a square symbol. Runs with recruitment parameter h (steepness) at a constraint are shown with hollow symbols; others, with solid symbols. Run labels (letters) match Table 2. Vertical lines represent MSST. Horizontal and oblique lines represent MFMT.